

WHAT IS CLAIMED IS:

1. A fuel cell output characteristic estimating apparatus for estimating an output characteristic of a fuel cell, comprising:

a current-voltage detector that detects an output current of the fuel cell and a voltage between terminals of the fuel cell; and

a controller that estimates the output characteristic of the fuel cell on the basis of the detected output current and the detected voltage between the terminals, detected by the current-voltage detector, and a basic output characteristic of the fuel cell.

2. A fuel cell output characteristic estimating apparatus according to claim 1, wherein the controller derives the basic output characteristic from at least one of a fuel supply pressure applied to the fuel cell and a temperature of the fuel cell.

3. A fuel cell output characteristic estimating apparatus according to claim 2, wherein the controller derives the basic output characteristic from an output characteristic of the fuel cell corresponding to at least one of the fuel supply pressure applied to the fuel cell and the temperature of the fuel cell, and an internal resistance of the fuel cell corresponding to the temperature of the fuel cell.

4. A fuel cell output characteristic estimating apparatus according to claim 1, wherein the controller estimates an internal resistance of the fuel cell on the basis of the detected output current, the detected voltage between the terminals, and the basic output characteristic, and estimates the output characteristic of the fuel cell on the basis of the estimated internal resistance of the fuel cell.

5. A fuel cell output characteristic estimating apparatus according to claim 2, wherein the controller estimates an internal resistance of the fuel cell on the basis of the detected output current, the detected voltage between the terminals, and the basic output characteristic, and estimates the output characteristic of the fuel cell on the basis of the estimated internal resistance of the fuel cell.

6. A fuel cell output characteristic estimating apparatus according to claim 3, wherein the controller estimates the internal resistance of the fuel cell on the basis of the detected output current, the detected voltage between the terminals, and the basic output characteristic, and estimates the output characteristic of the fuel cell on the basis of the estimated internal resistance of the fuel cell.

7. A fuel cell output characteristic estimating apparatus according to claim 6, wherein the controller estimates the output characteristic of the fuel cell on

the basis of the output characteristic corresponding to at least one of the fuel supply pressure applied to the fuel cell and the temperature of the fuel cell, and the estimated internal resistance.

8. A fuel cell system having a fuel cell, the fuel cell system further comprising:

a fuel cell output characteristic estimating apparatus for estimating an output characteristic of the fuel cell, including a current-voltage detector that detects an output current of the fuel cell and a voltage between terminals of the fuel cell, and a controller that:

estimates the output characteristic of the fuel cell on the basis of the detected output current and the detected voltage between the terminals, detected by the current-voltage detector, and a basic output characteristic of the fuel cell;

sets a target output of the fuel cell using the output characteristic of the fuel cell estimated by the controller; and

adjusts an output of the fuel cell such that the set target output is generated by the fuel cell.

9. A fuel cell system according to claim 8, further comprising:  
a power supply that supplies electric power to and receives the electric power from the fuel cell system, wherein:

the controller sets the target output of the fuel cell on the basis of an output required to be generated by the fuel cell system; and

when the set target output of the fuel cell is in excess of or short of the required output of the fuel cell system, the controller changes supply of the electric power to or from the power supply.

10. A fuel cell system according to claim 9, wherein the controller includes a transformer that is connected to terminals of the power supply and transforms the voltage between the terminals of the power supply so as to be applied to output terminals of the fuel cell.

11. A fuel cell system according to claim 8, wherein the controller changes the voltage between the terminals of the fuel cell into a voltage corresponding to the set target output.

12. A fuel cell system according to claim 9, wherein the controller changes the voltage between the terminals of the fuel cell into a voltage corresponding to the set target output.

13. A fuel cell system according to claim 10, wherein the controller changes the voltage between the terminals of the fuel cell into a voltage corresponding to the set target output.

14. A vehicle comprising a fuel cell system, the fuel cell system comprising:

a fuel cell;

a fuel cell output characteristic estimating apparatus for estimating an output characteristic of the fuel cell, including a current-voltage detector that detects an output current of the fuel cell and a voltage between terminals of the fuel cell, and a controller that:

estimates the output characteristic of the fuel cell on the basis of the detected output current and the detected voltage between the terminals, detected by the current-voltage detector, and a basic output characteristic of the fuel cell;

sets a target output of the fuel cell using the output characteristic of the fuel cell estimated by the controller; and

adjusts an output of the fuel cell such that the set target output is generated by the fuel cell.

15. A vehicle according to claim 14, wherein the fuel cell system further comprises a power supply that supplies electric power to and receives the electric power from the fuel cell system, wherein:

the controller sets the target output of the fuel cell on the basis of an output required to be generated by the fuel cell system; and

when the set target output of the fuel cell is in excess of or short of the required output of the system, the controller changes supply of the electric power to or from the power supply.

16. A vehicle according to claim 15, wherein the controller includes a transformer that is connected to terminals of the power supply and transforms the voltage between the terminals of the power supply so as to be applied to output terminals of the fuel cell.

17. A vehicle according to claim 14, wherein the controller changes the voltage between the terminals of the fuel cell into a voltage corresponding to the set target output.

18. A method of estimating an output characteristic of a fuel cell, comprising the steps of:

(a) estimating a basic output characteristic of the fuel cell on the basis of at least one of a fuel supply pressure applied to the fuel cell and a temperature of the fuel cell; and

(b) estimating the output characteristic of the fuel cell on the basis of the estimated basic output characteristic of the fuel cell, a detected output current of the fuel cell, and a detected voltage between terminals of the fuel cell.

19. A method according to claim 18, wherein the basic output characteristic of the fuel cell is estimated using an output characteristic corresponding to at least one of the fuel supply pressure applied to the fuel cell and the temperature of the fuel cell, and an internal resistance of the fuel cell corresponding to the temperature of the fuel cell.

20. A method according to claim 18, wherein the output characteristic of the fuel cell is estimated using an internal resistance of the fuel cell estimated on the basis of the detected output current, the detected voltage between the terminals of the fuel cell, and the basic output characteristic.

21. A method according to claim 19, wherein the output characteristic of the fuel cell is estimated using an internal resistance of the fuel cell estimated on the basis of the detected output current, the detected voltage between the terminals of the fuel cell, and the basic output characteristic.

22. A method according to claim 21, wherein the output characteristic of the fuel cell is estimated using an output characteristic corresponding to at least one of the fuel supply pressure applied to the fuel cell and the temperature of the fuel cell, and the estimated internal resistance of the fuel cell.

23. A method of controlling an output of a fuel cell comprising the steps of:

(a) estimating a basic output characteristic of the fuel cell on the basis of at least one of a fuel supply pressure applied to the fuel cell and a temperature of the fuel cell;

(b) estimating the output characteristic of the fuel cell on the basis of the estimated basic output characteristic of the fuel cell, a detected output current of the fuel cell, and a detected voltage between terminals of the fuel cell;

(c) setting a target output using the estimated output characteristic of the fuel cell; and

(d) controlling an output of the fuel cell such that the fuel cell

generates the set target output.

24. A method according to claim 23, wherein the step of estimating the basic output characteristic of the fuel cell includes using an output characteristic corresponding to at least one of the fuel supply pressure applied to the fuel cell and the temperature of the fuel cell, and an internal resistance of the fuel cell corresponding to the temperature of the fuel cell.

25. A method according to claim 23, wherein the step of estimating the output characteristic of the fuel cell includes using an internal resistance of the fuel cell estimated on the basis of the detected output current, the detected voltage between the terminals of the fuel cell, and the basic output characteristic.

26. A method according to claim 23, wherein the step of estimating the output characteristic of the fuel cell includes using an output characteristic corresponding to at least one of the fuel supply pressure applied to the fuel cell and the temperature of the fuel cell, and the estimated internal resistance of the fuel cell.

27. A method according to claim 23, wherein:  
the target output is set on the basis of an output required to be generated by a fuel cell system including a power supply that supplies electric power to and receives the electric power from the fuel cell system; and

when the set target output of the fuel cell is in excess of or short of the required output of the fuel cell system, supply of the electric power to or from the power supply is changed.

28. A method according to claim 27, wherein a voltage between the terminals of the power supply connected to output terminals of the fuel cell is transformed such that the voltage between the terminals of the fuel cell becomes a voltage corresponding to the target output.

29. A data storage medium that stores a computer readable program that causes a computer to function as a controller for computing an output characteristic of a fuel cell, the data storage medium comprising a computing program that:

derives a basic output characteristic of the fuel cell on the basis of at least one of a fuel supply pressure applied to the fuel cell and a temperature of the fuel cell; and

derives the output characteristic of the fuel cell on the basis of the derived basic output characteristic of the fuel cell, a detected output current of the fuel cell, and a detected voltage between terminals of the fuel cell.

30. A data storage medium according to claim 29, wherein the computing program derives the basic output characteristic using an output characteristic corresponding to at least one of the fuel supply pressure applied to the fuel cell and the temperature of the fuel cell, and an internal resistance of the fuel cell corresponding to the temperature of the fuel cell.

31. A data storage medium according to claim 29, wherein the computing program estimates the output characteristic of the fuel cell using an internal resistance of the fuel cell estimated on the basis of the detected output current, the detected voltage between the terminals of the fuel cell, and the basic output characteristic.

32. A data storage medium according to claim 30, wherein the computing program estimates the output characteristic of the fuel cell using an internal resistance of the fuel cell estimated on the basis of the detected output current, the detected voltage between the terminals of the fuel cell, and the basic output characteristic.

33. A data storage medium according to claim 31, wherein the computing program derives the output characteristic of the fuel cell using an output characteristic corresponding to at least one of the fuel supply pressure applied to the fuel cell and the temperature of the fuel cell, and the estimated internal resistance.

34. A data storage medium that stores a computer readable program that causes a computer to function as a device for controlling a fuel cell, the data storage medium comprising a computing program that:

derives a basic output characteristic of the fuel cell on the basis of at least one of a fuel supply pressure applied to the fuel cell and a temperature of the fuel cell;

derives an output characteristic of the fuel cell on the basis of the derived basic output characteristic of the fuel cell, a detected output current of the fuel cell, and a detected voltage between terminals of the fuel cell;

sets a target output of the fuel cell using the derived output characteristic of the fuel cell; and

controls the output of the fuel cell such that the fuel cell generates the set target output.

35. A data storage medium according to claim 34, wherein the computing program derives the basic output characteristic of the fuel cell using an

09900264-11201

output characteristic corresponding to at least one of the fuel supply pressure applied to the fuel cell and the temperature of the fuel cell, and an internal resistance of the fuel cell corresponding to the temperature of the fuel cell.

36. A data storage medium according to claim 34, wherein the  
5 computing program estimates the output characteristic of the fuel cell using an internal resistance of the fuel cell estimated on the basis of the detected output current, the detected voltage between the terminals of the fuel cell, and the basic output characteristic.

37. A data storage medium according to claim 34, wherein the  
10 computing program derives the output characteristic of the fuel cell using an output characteristic corresponding to at least one of the fuel supply pressure applied to the fuel cell and the temperature of the fuel cell, and the estimated internal resistance.

38. A data storage medium according to claim 34, wherein the  
15 computing program sets the target output on the basis of the output required to be generated by the fuel cell system including a power supply that supplies electric power to and receives the electric power from the fuel cell, and to change supply of the electric power to or from the power supply when the set target output of the fuel cell is in excess of or short of the required output of the fuel cell system.

39. A data storage medium according to claim 38, wherein the  
20 computing program causes the voltage between the terminals of the power supply connected to the output terminals of the fuel cell to be transformed such that the voltage between terminals of the fuel cell becomes a voltage corresponding to the set target output.